

ABSTRACT

[145] Robotic systems for modeling, mapping and exploring subterranean void spaces such as mines, caves, tunnels, bunkers, and conduits. Robotic modeling of subterranean voids is generally enabled by a procedural system consisting of preprocessing, ingress, void modeling, mapping and navigation, exploration, conveying payloads other than void modeling sensors, egress, and post processing. The robots can either be imposed mobility or can be self mobile with either autonomous, remote, teleoperated, or manual modes of operation. The robot may optionally transform from a compact size into a more conventional operating size if the operating size exceeds the void entry opening size. Void geometries with flat floors are amenable to robot locomotion such as rolling, crawling, walking or swimming. Alternatively, irregular floor geometries that preclude self mobilization may be accessible by imposed mobilization such as dropping or pushing a movable robotic sensor into such voids. The robotic device is preferably adaptable to voids filled with a gas or liquid. To maximize mapping applicability, the robot optionally includes sensing, locomotion and environmental tolerance to submersion and safeguarding, according to use criteria.